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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/671,802	09/28/2000	Jozef M. Finders	PM 0273961	7922

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EXAMINER

CHACKO DAVIS, DABORAH

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 04/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/671,802	FINDERS ET AL.	
	Examiner	Art Unit	
	Daborah Chacko-Davis	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 January 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) 18-22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17, and 23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-4, 17, and 23, are rejected under 35 U.S.C. 102(e) as being anticipated by U. S. Patent No. 6,387,596 (Cole et al).

Cole, in the abstract, in col 2, lines 23-42, in col 3, lines 28-67, in col 4, lines 1-54, discloses a method of forming a patterned structure on a substrate comprising forming a photosensitive resist on a substrate, performing a first exposure using a first mask to image a first pattern (nested images) on the resist, performing a second exposure using a trim mask (second mask) to image a second pattern (lines images) on the resist, wherein the first and second exposures are performed using off-axis illumination such as dipole illumination (claims 1-3, 17, and 23). Cole, in col 4, lines 4-35, discloses that the masks are exchanged between the first and second exposures (claim 4).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-3, 5-10, 14, and 17, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,476, 736 (Tanabe) in view of U. S. Patent No. 5,821,034 (Kim et al).

Tanabe, in col 2, lines 45-57, in col 5, lines 48-60, in col 6, lines 5-39, and in figures 4A, and 4B, discloses a method of projecting an image onto the surface of a photoresist coated wafer using a projection optical system, comprising performing a first exposure using a first mask (reference 4) to form a first optical image on the photoresist film (image partly), performing a second exposure using a second mask (reference 4) to form a second optical image on the photoresist film, wherein the first and second exposures are illuminated by an illumination beam that has a quadrupole or annular distribution (see references 1, 2, and 3 of figures 4A-4B) (claims 1-3). Tanabe, in col 6, lines 11-17, lines 25-29, and lines 46-48, discloses that the mask used for the double exposure process has sub patterns (square shapes, reference 37 of figure 6) and that the first exposure exposes the subpatterns partly to form a first optical image and the second exposure exposes the subpatterns partly to form a second optical image (claim 5). Tanabe, in col 5, lines 16-32, and lines 54-60, and in figures 3, 4A-4B, and 6, discloses that the illumination mode (beam) is used to image linear features of the

pattern (see figure 6) oriented perpendicular (substantially) to an axis (reference 1 of figures 3, 4A-4B) joining the two poles of the substantially dipolar intensity distribution to form a pattern on the resist film that defines the mask sub-patterns (square shapes)(claims 6-7). Tanabe, in col 5, lines 16-56, and in figure 3, discloses that the illumination system (reference 1) comprise a general relatively weak background intensity (the beam of light is partially darkened and is reduced in light or demagnified) (claim 8). Tanabe, in col 8, lines 50-67, and in col 9, lines 1-21, discloses that between the first exposure and the second exposure the wavelength of the illumination beam is changed resulting in a change in intensity of the illumination beam used in the second exposure process (claim 9). Tanabe, in col 7, lines 1-39, and in col 8, lines 1-19, discloses that the focus of a pattern of the substrate is adjusted (different focal planes employed at each exposure) between the first exposure and the second exposure to ensure optimal focus (very small variation or fluctuation of the obtainable hole size is observed) (claim 14). Tanabe, in col 5, lines 16-67, and in figure 3, discloses a method of exposure using a projection exposure system, comprising providing a photoresist-coated (energy sensitive material) wafer, providing a mask that has a given pattern, and imaging the mask pattern onto the resist coated substrate (claim 17).

The difference between the claims and Tanabe is that Tanabe does not disclose that at least one of the exposures is performed using an illumination mode having a substantially dipole intensity distribution. Tanabe does not disclose that the first and second exposures are in dipolar illumination mode and the axes of the two dipoles

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(reference 1 of figures 11A-11B) are perpendicular to the two illumination beams (mode) (reference 2) (claim 10).

Kim, in the abstract, and in col 2, lines 21-38, discloses that the primary and secondary exposures (first and second exposures) are performed using a dipole illumination aperture (illumination mode with dipole intensity) and that the axes of the two dipoles (spatial frequencies of horizontal and vertical axes) are perpendicular to each other.

Therefore, it would be obvious to a skilled artisan to modify Tanabe by employing the dipole illumination system suggested by Kim because in col 4, lines 4-30, discloses that using a dipole illumination aperture for exposure reduces manufacturing cost, and provides an increase in process margin.

5. Claims 4, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,476,736 (Tanabe) in view of in view of U. S. Patent No. 5,821,034 (Kim et al) as applied to claims 1-3, 5-10, 14, and 17 above, and further in view of U. S. Patent No. 5,563,012 (Neisser).

Tanabe in view of Kim is discussed in paragraph no. 2.

Tanabe, in col 2, lines 45-57, in col 5, lines 48-60, in col 6, lines 5-39, and in figures 4A, and 4B, discloses a method of projecting an image onto the surface of a photoresist coated wafer using a projection optical system, comprising performing a first exposure and a second exposure, wherein the first and second exposures are

illuminated by an off-axis illumination beam (see references 1, 2, and 3 of figures 4A-4B).

The difference between the claims and Tanabe in view of Kim is that Tanabe in view of Kim does not disclose that the masks are exchanged between the first exposure and the second exposure (claim 4). Tanabe does not disclose that the first mask is different from the second mask (claim 23).

Neisser, in col 3, lines 8-48, discloses exchanging the first overlay mask with a second overlay mask between successive exposures, and that the first overly mask is different from the second overlay mask.

Therefore, it would be obvious to a skilled artisan to modify Tanabe in view of Kim by changing the first mask with a different second mask between the exposures as taught by Neisser because Neisser, in col 1, lines 58-67, discloses that successive exposures of each of the different mask images results in enhanced a) resolution and b) depth of focus.

6. Claims 11-13, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,476,736 (Tanabe) in view of in view of U. S. Patent No. 5,821,034 (Kim et al) as applied to claims 1-3, 5-10, 14, and 17 above, and further in view of U. S. Patent Application Publication No. 2002/0109827 (Nishi).

Tanabe in view of Kim is discussed in paragraph no. 2.

Tanabe, in col 2, lines 45-57, in col 5, lines 48-60, in col 6, lines 5-39, and in

figures 4A, and 4B, discloses a method of projecting an image onto the surface of a photoresist coated wafer using a projection optical system, comprising performing a first exposure and a second exposure, wherein the first and second exposures are illuminated by an off axis illumination beam (see references 1, 2, and 3 of figures 4A-4B)

The difference between the claims and Tanabe in view of Kim is that Tanabe in view of Kim does not disclose that the exposure is performed using polarized electromagnetic radiation (claim 11). Tanabe in view of Kim does not disclose that the polarized radiation is linearly polarized (claim 12). Tanabe in view of Kim does not disclose that the polarized radiation has an electric component oriented substantially perpendicular to an axis joining the two poles of the dipolar intensity distribution (claim 13).

Nishi, in [0009], [0088], [0119], [0120], and [0121], and in figure 5, discloses that the illumination beam is a linearly polarized electromagnetic radiation (UV, 248nm), and that the electric component (ILP) is split by the beam splitter and is propagated perpendicular to the axis joining the two poles of the dipolar intensity distribution.

Therefore, it would be obvious to a skilled artisan to modify Tanabe in view of Kim by employing the method of using linearly polarized electromagnetic radiation and propagating the polarized light through a beam splitter as taught by Nishi because Nishi, in [0123], and in [0138] discloses that employing such a method of illumination mode, the resolution corresponding to a 256M-bit DRAM can be obtained with certainty while

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satisfying the condition regarding the permissible range of the depth of focus regardless of the thickness of the photoresist.

7. Claims 15-16, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,476,736 (Tanabe) in view of U. S. Patent No. 5,821,034 (Kim et al) as applied to claims 1-3, 5-10, 14, and 17 above, and further in view of U. S. Patent No. 6,263,099 (Maeda et al).

Tanabe in view of Kim is discussed in paragraph no. 2.

The difference between the claims and Tanabe in view of Kim is that Tanabe in view of Kim does not disclose that at least one of the exposures is performed with an attenuated phase shifted mask (claim 15). Tanabe does not disclose that the attenuation of the mask is chosen to balance the energy of radiation of the zeroth and first-order diffracted beams as they emerge from the pattern captured by a projecting system used to image the patterns on the substrate (claim 16).

Maeda, in col 21, lines 63-67, in col 22, lines 1-39, discloses that the mask used for the exposure process was of the attenuating type (attenuation filter), and that the attenuation filter was used to balance the intensity of the 0th order diffraction light and the first order diffraction light prior to imaging the pattern grid pattern.

Therefore, it would be obvious to a skilled artisan to modify Tanabe in view of Kim by employing a phase shifting mask as one the masks as suggested by Maeda because Maeda, in col 22, lines 19-39, discloses that balancing the 0th order diffraction

light and first order diffraction light with an attenuating material enables the grid pattern of the object to be detected with high resolution and high contrast.

Response to Arguments

8. Applicant's arguments, see REMARKS, on page 6, and page 7, filed on 01/16/2004, have been fully considered but they are not persuasive. The 103 rejections made in the previous office action are maintained.

(A) Applicants argue that Tanabe does not disclose performing a first exposure to image a first pattern, and performing a second exposure to image a second pattern.

Tanabe, in col 6, lines 2-17, discloses performing a first exposure to form a first defocused optical image (first pattern) on the resist film, and Tanabe, in col 6, lines 19-34, discloses performing a second exposure to form a second defocused optical image on the resist film (second pattern).

(B) Applicants argue that Kim does not disclose performing a first exposure to form a first pattern, and performing a second exposure to image a second pattern.

Kim is not depended upon to teach a first exposure to form a first pattern, and a second exposure to form a second pattern. Kim is depended upon to disclose the use of dipolar illumination aperture to perform a dipolar illumination exposure process. Also see paragraph (A).

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status

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information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

dcd

WD
April 23, 2004.

A handwritten signature in black ink, appearing to read "Mark F. Huff", with a long, sweeping horizontal line extending to the right.

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700